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18. RI/BRA SUMMARY AND CONCLUSIONS

The objectives of the Operable Unit (OU) 10-04 comprehensive Remedial Investigation (RI)/Baseline Risk Assessment (BRA) were to (1) fill data gaps identified in the OU 10-04 RI/Feasibility Study (FS) work plan (Department of Energy Idaho Operations Office [DOE-ID] 1999), (2) determine the nature and extent of contamination associated with Waste Area Groups (WAGs) 6 and 10 sites included in this study, (3) estimate the current and future comprehensive risk posed by OU 10-04 contaminants of potential concern (COPCs) to human health and the environment, and (4) perform an Idaho National Engineering and Environmental Laboratory (INEEL)-wide Ecological Risk Assessment (ERA). To meet these objectives, the field investigations defined in the work plan (DOE-ID 1999) were completed. The new data generated by the field investigations were evaluated in combination with the existing body of information to develop the comprehensive BRA and ERA.

Identified solid waste management sites and potentially hazardous sites in WAG 6 were established in the *Federal Facilities Agreement and Consent Order* (FFA/CO) (DOE-ID 1991). WAG 6 was divided into five OUs. Each OU was further divided into release sites. The WAG 6 sites were placed in one of five OUs (OUs 6-01, -02, -03, -04, and -05). One group of five sites was placed in a No Action Category without an OU. Since the FFA/CO was signed, two sites (Boiling Water Experiment [BORAX]-08 and BORAX-09) were identified as WAG 6 concerns and are included in the OU 10-04 RI/BRA. Table 18-1 presents the results of the OU 10-04 BRA and ERA for the WAG 6 sites.

Included in WAG 10 are miscellaneous INEEL sites and the Snake River Plain Aquifer (SRPA) outside the other WAGs. The FFA/CO identified 42 release sites, including solid waste management or potentially hazardous sites, for evaluation under WAG 10 (DOE-ID 1991). For WAG 10, the sites were originally divided into one No Action OU (i.e., OU none) and five action OUs (i.e., OUs 10-01, -02, -03, -04, and -05). Since signing the FFA/CO (DOE-ID 1991), additional sites and OUs have been added to WAG 10. OU 10-06 was developed for the radionuclide-contaminated soil sites across the INEEL. The OU 10-07 Telecommunications Cable was identified as a potential OU under WAG 10 (Baumer 1993). Both Security Training Facility (STF)-01 (STF Sumps and Pits) and STF-02 (Gun Range Berm) were added to OU 10-04 using the New Site Identification (NSI) process. The sitewide SRPA issues will be evaluated in a separate study, the OU 10-08 RI/FS. Table 18-2 presents the results of the OU 10-04 BRA and ERA for the WAG 10 sites/areas.

Site Chemical Processing Plant (CPP)-66, the Fly Ash Pit at Idaho Nuclear Technology and Engineering Center (INTEC) was retained as a site of potential concern for ecological risk in the OU 10-04 work plan. This site was evaluated in the OU 3-13 comprehensive RI/FS (DOE-ID 1997) and found not to pose an unacceptable risk to human health, but was not evaluated for ecological risk at that time. A facility assessment was conducted for the EBR-I reactor building, and no outstanding issues were identified. The reactor building is currently a National Historic Landmark, and tours are conducted for the public.

Descriptions of the individual sites and the investigations are provided in the preceding chapters. A summary of site and contaminant screening is contained in Section 4. Previous investigations of the release sites and the data acquired under the OU 10-04 comprehensive work plan (DOE-ID 1999) were reviewed to focus the BRA on those sites with a potential impact on cumulative risk. Twenty sites and one group of sites (the 29 ordnance areas) were retained for quantitative analysis in the OU 10-04 BRA (see Table 3-1 from the OU 10-04 Work Plan) (DOE-ID 1999). One site, the STF gun range (STF-02)

Table 18-1. Final decisions and recommendations for all WAG 6 release sites.

Site	COPCs exceeded RBCs and/or EBSLs?	HH cancer risks above 1E-04 or HIs greater than 1?	ERA HQs greater than 10?	Conclusions and recommendations for each site	Final action determination or recommendation	Retained for evaluation in the FS
BORAX-01	Yes	No	No	Section 7.7	Recommended for NFA	No
BORAX-02	Yes	No	No	Section 7.7	Recommended for NFA	No
BORAX-03	NA	NA	NA	Section 3.2.3	NFA	No
BORAX-04	NA	NA	NA	Section 3.2.3	NFA	No
BORAX-05	NA	NA	NA	Section 3.2.4	NFA	No
BORAX-07	NA	NA	NA	Section 3.2.4	NFA	No
BORAX-08	Yes	No	No	Section 7.7	Recommended for NFA	No
BORAX-09	Yes	No ^c	No	Section 7.7	Recommended for NFA	No
EBR-01	No	—	—	Section 6.3	Remain under current management controls	No
EBR-02	NA	NA	NA	Section 3.2.1	NFA	No
EBR-03	No	—	—	Section 5.7	Recommended for NFA	No
EBR-04	No	—	—	Section 5.7	Recommended for NFA	No
EBR-05	NA	NA	NA	Section 3.2.1	NFA	No
EBR-06	NA	NA	NA	Section 3.2.1	NFA	No
EBR-07	NA	NA	NA	Section 3.2.4	NFA	No
EBR-08	Yes	No ^a	No ERA ^b	Section 8.7	Recommended for NFA	No
EBR-09	Yes	No HHRA	No	Section 8.7	Recommended for NFA	No
EBR-10	Yes	No ^a	No ERA ^b	Section 8.7	Recommended for NFA	No
EBR-11	Yes	No HHRA	No ERA ^b	Section 8.7	Recommended for NFA	No
EBR-12	Yes	No HHRA	No ERA ^b	Section 8.7	Recommended for NFA	No
EBR-13	NA	NA	NA	Section 3.2.4	NFA	No
EBR-14	NA	NA	NA	Section 3.2.4	NFA	No
EBR-15	Yes	No HHRA	No ERA ^d	Section 9.7	Recommended for NFA	No
OU 6-05	*	*	*	Section 3.3.7	Recommended for NFA	No

NA. Site was eliminated before contaminant screenings were conducted.

a. The human health (HH) risks were assessed by using the risk-based corrective action (RBCA) model.

b. No pathway to ecological receptors.

c. The HH risks were assessed using Microshield version 5.03b.

d. Threshold reference values (TRVs) could not be developed for COPCs from this site, because of the lack of toxicity information. COPCs were assessed qualitatively.

* Sites under this OU were eliminated under other WAGs or other OUs, see Section 3.3.7.

Table 18-2. Final decisions and recommendations for all WAG 10 release sites/areas.

Site/Areas	COPCs exceeded RBCs and/or EBSL?	HH cancer risks are not within the target risk range or HIs are greater than 1?	ERA HQs are greater than 10?	Conclusions and recommendations for each site	Final action determination or recommendation	Retained for evaluation in the FS
ARVFS-01	NA	NA	NA	Section 3.3.1	NFA	No
ARVFS-02	NA	NA	NA	Section 3.3.1	NFA	No
DF-01	NA	NA	NA	Section 3.3.1	NFA	No
EOCR-01	NA	NA	NA	Section 3.3.1	NFA	No
EOCR-02	NA	NA	NA	Section 3.3.1	NFA	No
EOCR-03	NA	NA	NA	Section 3.3.1	NFA	No
EOCR-04	NA	NA	NA	Section 3.3.1	NFA	No
EOCR-05	NA	NA	NA	Section 3.3.1	NFA	No
Fly Ash Pit	Yes	No HHRA	No	Section 15.7	Recommended for NFA	No
LCCDA-01	Yes	No	No	Section 10.7	Recommended for NFA	No
LCCDA-02	Yes	No	No	Section 10.7	Recommended for NFA	No
OMRE-01	Yes	No	No	Section 11.7	Recommended for NFA	No
OU 10-03/ 10-05 ^a	Yes	Yes ^b	Yes ^c	Section 12.6	Retained for further evaluation	Yes
OU 10-06 ^d	NA	NA	NA	Section 3.3.7	NFA	No
OU 10-07	No	—	—	Section 16.7	Institutional controls	No
STF-01	No	—	—	Section 13.7	Recommended for NFA	No
STF-02	Yes	Yes	Yes	Section 14.11	Retained for further evaluation	Yes
ZPPR-01	NA	NA	NA	Section 3.3.1	NFA	No

NA. Site was eliminated before contaminant screenings were conducted.

a. See Section 12.6 for a complete list of ordnance areas under this OU.

b. See Section 12 for a complete list of cancer and noncancer risks for the human health risk assessment (HHRA) at the ordnance areas under this OU.

c. See Section 12 for a complete list of COPCs and hazard quotients (HQs) for the ERA at the ordnance areas under this OU.

d. Sites under this OU were eliminated under other WAGs or other OUs, see Section 3.3.7.

and two groups of sites (the ordnance areas with trinitrotoluene [TNT] and Royal Demolition Explosive [RDX] soil contamination), and those areas with hazards due to unexploded ordnance [UXO]) were found to have the potential for producing unacceptable future residential exposure risk. Within the generalized framework of concerns (i.e., contamination to plants, animals, land, and water) expressed by the Shoshone-Bannock Tribal Risk Assessment Committee (Appendix A), these sites also pose an unacceptable risk. These same sites were found to have the potential for producing unacceptable ecological risk. The development and results of the quantified evaluation are summarized in the following sections.

The nature and extent of contamination, fate and transport, and potential human health risks associated with the OU 10-04 sites retained for quantitative evaluation in the BRA are discussed in Sections 5 through 17. The analyses in these sections were developed primarily to support the human

health component of the BRA. The source term concentrations also were applied to the ERA presented in Section 4. However, the ERA component of the BRA includes a separate site and contaminant screening analysis.

The risks and Hazard Indices (HIs) by exposure pathway for the future residential, future occupational, and current occupational scenarios are summarized in Tables 18-3 through 18-8 for each site group. Each site group is a specific geographic location. Although the residential scenario has not been identified as a likely future land use, the future residential scenario is used in the decision-making process as the most conservative risk assessment approach. Of the areas quantitatively evaluated, the following explosives-contaminated soil sites contain sources of contamination that have the potential for producing human health risk greater than or equal to $1\text{E-}04$ and an HI greater than or equal to 1 for the future residential scenario:

- Experimental Field Station
- Firestation II Zone and Range Fire Burn Area
- Land Mine and Fuze Burn area
- National Oceanic and Atmospheric Administration (NOAA)
- Naval Ordnance Disposal Area (NODA).

The STF-02 Gun Range was found to have lead concentrations that exceeded the Environmental Protection Agency (EPA) Interim Soil Lead Guidance Level of 400 ppm (Elliott 1994) and thereby also present an unacceptable human health risk.

In addition, while a quantitative risk assessment was not performed for the confirmed UXO areas, it is recognized that there is a risk of uncontrolled detonation associated with these sites. Some of the known UXO locations are near areas frequented by INEEL personnel, and encounters with UXO are fairly common for workers in the field in these locations. The potential also remains for future risks, either to workers or potential residents. The areas with confirmed UXO, and those with the potential for subsurface UXO, were identified as exhibiting a risk to human health that requires evaluation for remediation. The evaluations of these sites are summarized below.

18.1 Nature and Extent of Contamination Summary

The lead contamination associated with the STF-02 Gun Range is from the bullets fired during small arms target practice. The lead contamination is present as large fragments as well as finely disseminated fragments within the soils. The lead contamination is widely distributed across this site with elevated concentrations up to 24,400 mg/kg in one of the berms.

To date, 29 ordnance areas have been identified on the INEEL. Most of these sites stem from activities conducted at the Naval Proving Ground in the 1940s. Activities conducted at these sites include testing of guns and mass detonation experiments and tests. As a result of these activities, many projectiles, explosive materials, pieces of explosives, and UXO remain. Soil contamination with TNT and RDX is found in many areas. Stained soil and chunks of explosives can be visually identified and correlate with areas of higher soil concentrations. The vertical extent of contamination is limited to the shallow soils, up to 0.61 m (2 ft) below ground surface (bgs). The presence of UXO has been confirmed at some of the ordnance areas and is suspected at others. Clearance of UXO and field assessments have occurred at several sites each field season from 1993 through 1997, and a walkdown was performed in 2000 to better define the extent of UXO.

Table 18-3. Total risks by exposure pathway and group (future residential scenario).

	Exposure Pathway									Total Risk
	Ingestion of Soil	Ingestion of Groundwater	Ingestion of Homegrown Produce	Inhalation of Fugitive Dust	Inhalation of Volatiles from Soil	Inhalation of Volatiles from Groundwater	External Radiation Exposure ^a	Dermal Absorption of Soil	Dermal Absorption of Groundwater	
BORAX	2E-07	5E-14	3E-15	8E-09	—	—	4E-05	—	—	4E-05
EBR-I	9E-08	1E-07	1E-07	4E-11	6E-12	9E-08	—	4E-07	4E-08	9E-07
LCCDA	3E-07	6E-15	3E-15	4E-08	—	—	5E-05	—	—	5E-05
OMRE	4E-06	4E-07	4E-06	4E-09	—	—	6E-05	2E-05	8E-07	9E-05
Burn Ring	— ^b	— ^c	— ^c	— ^b	—	—	—	— ^b	— ^b	— ^{b,c}
Firestation	4E-06	4E-06	6E-05	1E-10	1E-14	6E-10	—	5E-05	4E-08	1-04
Fieldstation	3E-06	4E-07	6E-05	3E-09	—	—	—	2E-05	3E-09	9E-05
Mine Fuze	2E-04	5E-05	4E-03	1E-11	—	—	—	2E-03	4E-07	6E-03
NOAA	5E-05	4E-05	1E-03	9E-10	—	—	—	4E-04	4E-07	1E-03
NODA	3E-05	1E-02	2E-03	5E-09	2E-13	5E-09	—	7E-05	3E-05	2E-02
CFA-633	2E-07	1E-05	3E-06	2E-10	—	—	—	3E-07	3E-08	1E-05

Lack of risk values in this table indicates that no COPCs were present at this site/area to be evaluated for the specific pathway.

a. If no risk values are presented in this column for a site/area, then no radionuclides were retained in the HHRA.

b. Slope factors are not available for 4-chloro-3-methylphenol. Consequently, risk values from this exposure pathway were not calculated.

c. 4-Chloro-3-methylphenol was not included in the GW Screen analysis, because of the lack of a soil-water partition coefficient (Kd) for this contaminant.

Table 18-4. Total hazard quotients by area (future residential scenario).

	Exposure Pathway								Total HI
	Ingestion of Soil	Ingestion of Groundwater	Ingestion of Homegrown Produce	Inhalation of Fugitive Dust	Inhalation of Volatiles from Soil	Inhalation of Volatiles from Groundwater	Dermal Absorption of Soil	Dermal Absorption of Groundwater	
BORAX ^a	—	—	—	—	—	—	—	—	—
EBR	2.41E-03	3.90E-03	3.17E-03	2.03E-06	3.04E-07	4.42E-03	2.58E-05	5.36E-05	1.40E-02
LCCDA ^b	—	—	—	—	—	—	—	—	—
OMRE ^c	—	—	—	—	—	—	—	—	—
Burn Ring ^d	—	—	—	—	—	—	—	—	—
Firestation	3.99E-01	6.23E-01	8.85E+00	1.95E-05	—	—	8.53E-03	2.65E-04	9.88E+00
Fieldstation	4.38E-01	6.11E-02	9.19E+00	4.25E-04	—	—	9.35E-03	2.60E-05	9.70E+00
Mine Fuze	3.06E+01	7.89E+00	6.51E+02	1.92E-06	—	—	6.53E-01	3.35E-03	6.90E+02
NOAA	7.19E+00	6.41E+00	2E+02	1.43E-04	—	—	2E-01	2.72E-03	1.66E+02
NODA	2.02E-01	1.46E+02 ^e	1E+01 ^e	3.70E-05	—	—	8.02E-04	1.30E-02	1.60E+02
CFA-633	3.65E-03	1.11E-01	8.13E-02	3.54E-06	—	—	5.49E-05	2.48E-05	1.96E-01

Lack of risk values in this table indicates that no COPCs were present at this site/area to be evaluated for the specific pathway.

a. COPCs at all BORAX sites included radionuclides only.

b. COPCs at Liquid Corrosive Chemical Disposal Area (LCCDA)-01 and LCCDA-02 included radionuclides only.

c. RfDs are not available for benzo(a)pyrene and chrysene. Consequently, risk values for all exposure pathways could not be calculated.

d. RfDs are not available for 4-chloro-3-methylphenol. Consequently, risk values for all exposure pathways could not be calculated. 4-Chloro-3-methylphenol was not included in the GWSCREEN because of the lack of a soil-water partition coefficient (Kd) for this contaminant.

e. 2-Pentanone was not included in the GW Screen analysis because of the lack of a soil-water partition coefficient (Kd) for this contaminant.

Table 18-5. Total risks by exposure pathway and group (future worker scenario).

	Exposure Pathway					Total Risk
	Ingestion of Soil	Inhalation of Fugitive Dust	Inhalation of Volatiles from Soil	External Radiation Exposure ^a	Dermal Absorption of Soil	
BORAX	3E-08	6E-09	—	6E-05	—	6E-05
EBR ^b	—	—	—	—	—	—
LCCDA	9E-07	2E-08	—	2E-05	—	3E-05
OMRE	4E-06	3E-09	—	1E-05	6E-06	2E-05
Burn Ring ^c	—	—	—	—	—	—
Firestation	2E-06	5E-10	7E-15	—	2E-05	2E-05
Fieldstation	6E-06	1E-08	—	—	6E-05	6E-05
Mine Fuze	4E-04	4E-11	—	—	3E-03	4E-03
NOAA	2E-05	1E-09	—	—	2E-04	2E-04
NODA	8E-06	5E-08	1E-13	—	3E-05	4E-05
CFA-633	4E-07	7E-10	—	—	7E-07	1E-06

Lack of risk values in this table indicates that no COPCs were present at this site/area to be evaluated for the specific pathway.

a. If no risk values are presented in this column for a site/area, then no radionuclides were retained in the HHRA.

b. TPH-diesel was evaluated using the RBCA model (see Section 8).

c. Slope factors are not available for 4-chloro-3-methylphenol. Consequently, risk values from this exposure pathway were not calculated.

Table 18-6. Total hazard quotients by exposure pathway and group (future worker scenario).

	Exposure Pathway				Total HI
	Ingestion of Soil	Inhalation of Fugitive Dust	Inhalation of Volatiles from Soil	Dermal Absorption of Soil	
BORAX ^a	—	—	—	—	—
EBR ^b	—	—	—	—	—
LCCDA ^c	—	—	—	—	—
OMRE ^d	—	—	—	—	—
Burn Ring ^e	—	—	—	—	—
Firestation	2E-01	8E-05	—	5E-03	2E-01
Fieldstation	1E+00	2E-03	—	3E-02	1E+00
Mine Fuze	7E+01	8E-06	—	2E+00	7E+01
NOAA	4E+00	3E-04	—	9E-02	4E+00
NODA	2E-01	2E-05	—	2E-04	2E-01
CFA-633	1E-02	2E-05	—	2E-04	1E-02

Lack of risk values in this table indicates that no COPCs were present at this site/area to be evaluated for the specific pathway.

a. COPCs at all BORAX sites included radionuclides only.

b. TPH-diesel was evaluated using the RBCA model (see Section 8).

c. COPCs at LCCDA-01 and LCCD-02 included radionuclides only.

d. RfDs are not available for benzo(a)pyrene and chrysene. Consequently, risk values for all exposure pathways could not be calculated.

e. RfDs are not available for 4-chloro-3-methylphenol. Consequently, risk values for all exposure pathways could not be calculated.

Table 18-7. Total risks by exposure pathway and group (current worker scenario).

	Exposure Pathway					Total Risk
	Ingestion of Soil	Inhalation of Fugitive Dust	Inhalation of Volatiles from Soil	External Radiation Exposure ^a	Dermal Absorption of Soil	
BORAX	1E-07	2E-09	—	2E-04	—	2E-04
EBR-I ^b	—	—	—	—	—	—
LCCDA	1E-06	2E-08	—	6E-05	—	6E-05
OMRE	4E-06	3E-09	—	1E-04	6E-06	1E-04
Burn Ring ^c	—	—	—	—	—	—
Firestation	2E-06	5E-10	7E-15	—	2E-05	2E-05
Fieldstation	6E-06	1E-08	—	—	6E-05	6E-05
Mine Fuze	4E-04	4E-11	—	—	3E-03	4E-03
NOAA	2E-05	1E-09	—	—	2E-04	2E-04
NODA	8E-06	5E-08	1E-13	—	3E-05	4E-05
CFA-633	4E-07	7E-10	—	—	7E-07	1E-06

Lack of risk values in this table indicates that no COPCs were present at this site/area to be evaluated for the specific pathway.

a. If no risk values are presented in this column for a site/area, then no radionuclides were retained in the HHRA.

b. TPH-diesel was evaluated using the RBCA model (see Section 8).

c. Slope factors are not available for 4-chloro-3-methylphenol. Consequently, risk values from this exposure pathway were not calculated.

Table 18-8. Total hazard quotients by exposure pathway and group (current worker scenario).

	Exposure Pathway				Total HI
	Ingestion of Soil	Inhalation of Fugitive Dust	Inhalation of Volatiles from Soil	Dermal Absorption of Soil	
BORAX ^a	—	—	—	—	—
EBR-I ^b	—	—	—	—	—
LCCDA ^c	—	—	—	—	—
OMRE ^d	—	—	—	—	—
Burn Ring ^e	—	—	—	—	—
Firestation	2E-01	8E-05	—	5E-03	2E-01
Fieldstation	1E+00	2E-03	—	3E-02	1E+00
Mine Fuze	7E+01	8E-06	—	2E+00	7E+01
NOAA	4E+00	3E-04	—	9E-02	4E+00
NODA	2E-01	2E-05	—	2E-04	2E-01
CFA-633	1E-02	2E-05	—	2E-04	1E-02

Lack of risk values in this table indicates that no COPCs were present at this site/area to be evaluated for the specific pathway.

a. COPCs at all BORAX sites included radionuclides only.

b. TPH-diesel was evaluated using the RBCA model (see Section 8).

c. COPCs at LCDDA-01 and LCDDA-02 included radionuclides only.

d. RfDs are not available for benzo(a)pyrene and chrysene. Consequently, risk values for all exposure pathways could not be calculated.

e. RfDs are not available for 4-chloro-3-methylphenol. Consequently, risk values for all exposure pathways could not be calculated.

18.2 Human Health Risk Evaluation Summary

The OU 10-04 comprehensive human health risk assessment consists of the two following broad phases of analysis: site and contaminant screening-identified release sites and COPCs that could produce adverse human health impacts to current and future workers and future residents at WAGs 6 and 10. The risk assessment also presented information about the release mechanisms responsible for the contamination, detected contaminants, and the source term estimates for assessing the baseline risk.

An exposure route analysis produced estimates of the human health risk for each COPC. The exposure route analysis included an exposure assessment, a toxicity assessment, and a risk characterization. The BRA includes an evaluation of human health risks associated with exposure to contaminants through soil ingestion, fugitive dust inhalation, volatile inhalation, external radiation exposure, groundwater ingestion, ingestion of homegrown produce, dermal absorption of groundwater, dermal absorption from soil, and inhalation of water vapors from indoor water use. Occupational health risks were estimated for the current scenario and for a future scenario beginning in 100 years. For the future residential scenario, risks were estimated beginning 100 years from now for all exposure pathways. In addition, future residential groundwater ingestion risk was estimated at peak contaminant concentration or 10,000 years in the future, whichever occurred first.

Arsenic was identified as a COPC for ingestion of soil and for groundwater ingestion for a number of the sites evaluated in the BRA. The potential human health effects of arsenic must be evaluated with consideration of the wide range of arsenic levels in regional background soils (see Appendix K). Because the arsenic levels detected in the OU 10-04 sites were within regional background, the contribution to risk from arsenic exposure is no greater than risks elsewhere in the region. Therefore, arsenic was eliminated as a COPC.

The results of the human health risk assessment relative to the evaluated exposure routes are summarized in Tables 18-3 through 18-8. The risks from each exposure scenario are summed for each site group, such as BORAX and EBR, due to the relatively small areal extent of these site groups. The total risk for each site group is also presented in the tables. The exposure routes with estimated carcinogenic excess risks greater than or equal to $1\text{E-}04$ or a noncarcinogenic hazard index (HI) greater than or equal to 1 are ingestion of soil, dermal absorption from soil, ingestion of groundwater, and ingestion of homegrown produce. The associated contaminants of concern (COCs) in soil for the future residential scenario are lead at the STF-02 Gun Range, and TNT and RDX contamination at the ordnance area.

The ordnance sites on the INEEL can pose a risk to current workers. Warning signs, procedures, and required training are in place that train people to recognize UXO and help prevent placing people at risk. Until the selection and implementation of a final remedy in the Record of Decision (ROD), control of the ordnance sites will be achieved through maintaining the current signs, procedures, and associated training. Remedies to provide protection for potential future workers or residents will be evaluated in the FS and selected in the ROD.

18.3 Ecological Risk Evaluation Summary

The OU 10-04 ERA is a component of the three-phased approach developed for ERA at the INEEL. The first phase, the ecological site and contaminant screening, determined which sites and contaminants would be subjected to further analysis in the comprehensive RI/FS. The second phase of the ERA is a site-by-site evaluation of the risks to ecological resources as a result of exposure to contaminants at the WAG level. The second-phase evaluation included a review of the screening completed in Phase 1 to ensure that sites or contaminants were not inappropriately omitted from further evaluation. The two phases integrate WAG-wide ERAs into a final INEEL-wide evaluation of potential

risks to ecological receptors. Phase 1 of the ERA for WAGs 6 and 10 was completed and documented in the OU 10-04 work plan. The second phase was included as a component of this OU 10-04 comprehensive RI/BRA and is presented in each individual site section, and in its entirety in Appendix F. Phase 3 is presented as the OU 10-04 ERA in Appendix H and is summarized in Section 17.

A complete discussion of the ERA for each individual site is presented in the individual chapters for each site (Sections 5 through 17). Twenty of the sites within OU 10-04 were retained for site-by-site evaluation. In addition, the contaminant screening is presented and conceptual site models are developed to support the evaluation. Surface and subsurface soils were the only media considered. Groundwater was eliminated as a medium of concern in the ERA because it is not accessible to ecological receptors. Surface water was eliminated because no significant permanent surface water features are contained within WAGs 6 and 10. There are a number of transient features, including the Big Lost River, the playas, and the spreading areas that provide habitat during some years, but this is not consistently available for use. The analysis addressed contaminant fate and transport properties, ecological exposure assessment, contaminant toxicity, and uncertainties inherent in the evaluation to develop a foundation for the ecological risk characterization.

All radionuclides were eliminated in the contaminant screening process. Therefore, the risk characterization generated a quantitative assessment of the potential risk for the nonradiological contaminants. The HQs were developed for each contaminant, selected endpoint species, and threatened or endangered (T/E) species and species of special concern (C2 species) potentially associated with each evaluated site in OU 10-04. If the approximated dose of a given contaminant did not exceed its toxicity reference value (i.e., if the contaminant had an HQ of less than 1.0 for nonradiological constituents), adverse effects to ecological receptors are not expected, and no further evaluation was recommended. The results for the retained sites are summarized in Table 18-9.

Ecological risks were identified for six of the OU 10-04 sites: Experimental Field Station, Fire Station II and Range Fire Burn Area, Land Mine and Fuze Burn Area, NOAA, NODA and STF-02 Gun Range. These sites all contained COPCs with HQs greater than 10. These are the same sites identified as presenting unacceptable risks to human health.

The OU 10-04 site-wide ERA is summarized in Section 17 and presented in its entirety in Appendix H.

18.4 Qualitative Native American Evaluation Summary

One of the goals of the OU 10-04 RI/BRA was to identify areas of particular concern within WAGs 6 and 10 for the Shoshone-Bannock Tribes. Because the INEEL is within the aboriginal territories of this Native American group, a wide variety of natural and cultural resources and areas that directly reflect tribal cultural heritage and native landscape ecology are preserved there. These resources are important to the Tribes in maintaining tribal spiritual and cultural values and activities, oral tradition and history, mental and economic well-being, and overall quality of life. To date, very few studies have been conducted to identify specific concerns of the Tribes in regard to these resources. However, a recent survey (Burger et al. 2000) including 130 Native American residents of Fort Hall, primarily Shoshone-Bannock Tribe members, clearly underscores their importance. In this study, most of the interviewees from Fort Hall expressed concerns about contamination of land, water, and air. Concerns about the well-being of game and other wildlife were also common, followed by concerns about human health. A significant percentage (14%) of older residents (mean age of 53 years compared to a mean age of 39 years for all those interviewed) mentioned concerns for disruptions of game migration routes.

Table 18-9. Summary of sites retained for ecological risk assessment.

Site	Exposure Pathway	HQs	COPC
Experimental Field Station	HGP, ERA	≤ 1 to ≤ 80	1,3-Dinitrobenzene
		≤ 1 to ≤ 300	2,4,6-Trinitrotoluene
Firestation II Zone and Range Fire Burn Area	HGP, ERA	≤ 1 to ≤ 40	2,4,6-Trinitrotoluene
		≤ 1 to ≤ 40	RDX
Land Mine and Fuze Burn Area	GW, HGP, ERA	≤ 1 to ≤ 4,000	1,3-Dinitrobenzene ^a
National Oceanic and Atmospheric Administration Grid	GW, HGP, ERA	≤ 1 to ≤ 200	1,3-Dinitrobenzene
		≤ 1 to ≤ 500	2,4,6-Trinitrotoluene
		≤ 1 to ≤ 20	RDX
Naval Ordnance Disposal Area 2	HGP	≤ 1 to ≤ 4000	RDX
		≤ 1 to ≤ 30	Copper ^b
Area 4		≤ 1 to ≤ 80	TPH-Diesel ^c
Security Training Facility Gun Range Berm STF-02	ERA	≤ 1 to ≤ 2000	Lead

GW = Groundwater

HGP = Homegrown produce

ERA = Ecological receptor pathways

a. 1,3-dinitrobenzene and 2,4-dinitrotoluene were not assessed as contaminants at the Land Mine and Fuze Burn Area because of uncertainties associated with the lab analysis. The exposure point concentrations used in the ERA were based on sample results that the lab flagged as a nondetect. There were significant issues with lab methods and the sample matrix that resulted in extremely high detection limits. These uncertainties limit the ability to determine risk to ecological receptors. However, the Land Mine and Fuze Burn Area are currently being evaluated for remediation from 2,4,6-TNT contamination, and presumably 1,3-dinitrobenzene and 2,4-dinitrotoluene would also be treated or removed as part of that remediation action. Post-remedial sampling for the Land Mine and Fuze Burn Area would also include analyzing for 1,3-dinitrobenzene and 2,4-dinitrotoluene to determine if any residual contamination is left behind. These COPCs are also being retained for the OU 10-04 ERA (Section 17).

b. Four sample results for copper were removed from the data set before the EPCs were calculated. These samples were removed because they were representative of small areas of elevated concentration. Based on the historic use of the area these samples were assumed to contain small pieces of copper metal. These four sample results have concentrations ranging from 24,000 to 772 mg/kg. Several other sample results showed levels above background, but they were significantly less in concentration. Therefore, risk from exposure to copper contamination at NODA Area 2 is not considered hazardous to ecological receptors. This COPC will no longer be retained or evaluated in the FS. However, this COPC will be retained for further evaluation in the OU 10-04 ERA (Section 17) because there is some potential for risk from exposure to copper.

c. Only two ecological receptors show risk from TPH-diesel with HQs above 10; the deer mouse and the pygmy rabbit. TPH-diesel is the only COPC at this site that presents any potential for risk. This contaminant is unlikely to pose an unacceptable risk to ecological receptors, because of the conservativeness in the ERA and should not be considered a COC at this site. TPH-diesel will no longer be evaluated in this ERA. A toxicity profile was developed for TPH-diesel to analyze this contaminant more qualitatively (see Appendix D, Attachment D1). However, because there is still some potential for risk, this COPC will be retained and evaluated in the OU 10-04 ERA (Section 17).

Concerns about long-term stewardship of the land and wildlife were also apparent in Fort Hall residents' responses to queries about future land use. They ranked returning the land to the Tribes, hunting, use as a wildlife preserve with no human use, camping, hiking, use as an environmental research preserve, and fishing highest on their lists of preferred future uses.

In an effort to further enhance understanding of Shoshone-Bannock concerns, particularly those directly associated with OU 10-04, WAG 10 consulted directly with the Shoshone-Bannock Tribal Risk Assessment Committee to provide unique input for this document. The general concerns identified by the Tribal Committee have been incorporated into preceding discussions as appropriate (in Sections 5 through 16), and the tribal report is presented in whole and unchanged as Appendix A.

In the holistic world view described in the tribal analysis completed for WAG 6/10 (Appendix A), concerns about land, air, water, plants, animals, and humans are paramount and all are interconnected. Changes, disturbances, and perceived voids in this native landscape ecology create an imbalance that extends through the entire traditional and spiritual ecosystem. At the INEEL, contamination and modern disturbances contribute to a perceived imbalance and are unacceptable to the Tribes. No thresholds, such as the screening levels established by the EPA and used throughout this document, are recognized in the tribal risk assessment. Even so, it is clear that sites that do exceed quantitative thresholds for risk to human health or ecological receptors will also be adverse to Shoshone-Bannock tribal concerns. Because all contamination is perceived as problematic, in preceding discussions (Sections 5 through 16); it is also recognized that some sites will be of concern for tribal interests even though quantitative analyses have demonstrated that the risks they pose are below established limits for human health and the environment. In the absence of specific information from the Tribes, it is not possible at this time to carry these sites forward for consideration of remedial action.

Although the tribal report (Appendix A) does not provide specific detail, it does suggest that action can be taken to correct changes, disturbances, and perceived voids in the native landscape ecology and thereby restore balance to the traditional and spiritual ecosystem. The goal of these actions is clearly focused on the preservation or restoration of a diverse and healthy environment. While the qualitative tribal perspective is distinct from the systematic ecological risk assessment methodologies discussed in Section 17, the two approaches do share this common goal. In the absence of specific information from the Tribes, it is assumed that existing remedial strategies designed to achieve *de minimis* risk for human and ecological communities (as discussed in Section 17) will serve as initial, if not final, steps toward addressing the holistic Native American concerns.

18.5 Release Sites to be Evaluated in Feasibility Study

All but 20 of the sites in OU 10-04 were eliminated from quantitative analysis based on site and contaminant screening criteria (see Section 4). Human health risk estimates were developed for these 20 sites (see Sections 5 through 17). The contaminants with the greatest potential for causing adverse human health effects for OU 10-04 sites (i.e., the contaminants for which the cumulative risk is greater than $1E-04$ or the hazard index is greater than 1) include lead, TNT, and RDX.

One individual site, STF-02, contains sources of contamination that have the potential for producing unacceptable risks to human health, based on comparison to EPA screening levels. Two groups of sites are identified as having the potential for producing unacceptable risk to human health, due to UXO and soil contamination with TNT and RDX. Remedial alternatives are identified and evaluated in the FS (see Sections 19 through 22) for the one individual site and the group of explosives-contaminated soil sites that contain sources of contamination with the potential for producing unacceptable human health risk in the 100-year future residential scenario. Remedial alternatives are

identified and evaluated in the FS for the UXO sites where there is confirmed UXO or the potential for subsurface UXO.

Six sites with HQs in excess of 1 were identified in the ERA. An additional screening was performed in which contaminants were eliminated as a concern if the exposure point concentration did not exceed 10 times the background concentration or if the HQ was less than 10. The results of the screening for WAGs 6 and 10 are presented in Table 18-9. These sites were forwarded for evaluation of remedial alternatives in the comprehensive FS (see Sections 19 through 22) to address risks to human health. Remedies selected for protection of human health will also address ecological receptors.

In total, one site and one site group were identified for evaluation of remedial alternatives in the FS: STF-02 Gun Range and Explosives-Contaminated Soil Sites for human health risks. The UXO sites were identified for evaluation of remedial alternatives due to the safety issues and risks to current workers and potential future workers, occasional land users, or residents. The following two sites are summarized below and shown in Figure 18-1.

Site STF-02 Gun Range was forwarded to the FS to address the human health risk, risk to ecological receptors, and the qualitative Native American concerns from exposure to lead in soil. This site contains soils that could be regulated under the Resource Conservation and Recovery Act (RCRA) as characteristic hazardous waste, due to leachable concentrations of lead (D008). Lead in bullet and metal fragment form is estimated to total more than 64 tons.

The Explosives-Contaminated Soil Sites (Experimental Field Station, Fire Station II Zone and Range Fire Burn Area, Land Mine and Fuze Burn Area, NOAA, and NODA) were forwarded to the FS to address the human health risk, risk to ecological receptors, and qualitative Native American concerns posed by the COPCs—TNT and RDX still remaining on the surface and in the shallow subsurface. These soils will not be regulated under RCRA, because the explosive concentrations are all less than 1%, and there are no other regulatory limits exceeded.

The areas with potential UXO were forwarded to the FS to address the risks from detonation of the UXO that remains exposed at the surface or within the shallow subsurface. The four areas with confirmed UXO retained for evaluation in the FS are:

- NODA
- Mass Detonation Area
- Rail Car Explosion Area
- Land Mine and Fuze Burn Area.

In addition, the following areas are retained for evaluation of possible subsurface UXO in the FS:

- Naval Proving Ground
- Arco High Altitude Bombing Range
- Twin Buttes Bombing Range.

In total, these areas cover approximately 1,036 km² (400 mi²).

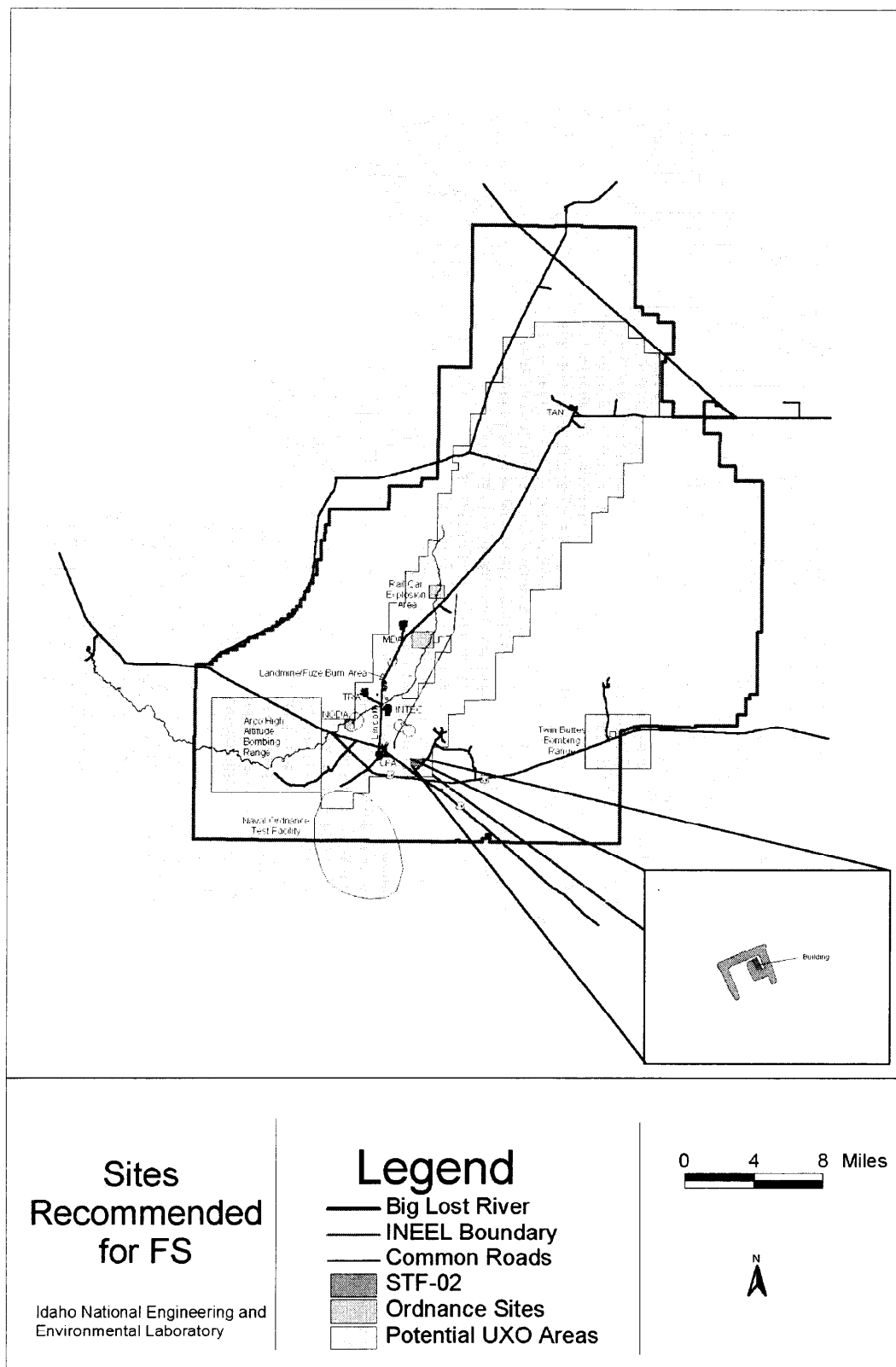


Figure 18-1. OU 10-04 Sites recommended for the Feasibility Study.

18.6 References

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